The observers were :—Mr. Wickham, indicated by W.
Mr. Robinson, ,, R.
Mr. McClellan, ,, C.

Radcliffe Observatory, Oxford:
1902 *June* 10.

Further Observations of the New Star in Perseus (5).

By A. Stanley Williams.

My early observations of this star up to 1901 June 10 have already been communicated to the Society.* The present paper contains the continuation up to the present time. The photometric magnitudes of a number of the fainter stars in the neighbourhood of the Nova have recently been published by Messrs. G. Müller and P. Kempf in the *Astronomische Nachrichten*, No. 3779, and these magnitudes have been adopted for the comparison stars in reducing the observations. The following is a list of the comparison stars used, with the magnitudes according to Müller and Kempf. The first column contains the designation of the star employed in the present observations.

Comparison Stars.

Designation.	Name.	Magnitude.
(32)	32 Persei	5·18
(36)	36 Persei	5·54
(30)	30 Persei	5·65
b	B.D. +43°·730	6·57
a	,, +44°·734	6·61
c	,, +43°·732	7·41
g	,, +43°·729	8·70
h	,, +43°·739	9·11

The above magnitudes have been used in reducing all the telescopic observations. But for those made with the opera-glass the magnitudes of *a* and *b* have been assumed to be 6·25 and 6·50. Both these stars are accompanied by bright companions, and the presence of the latter evidently affected the brightness as observed with the opera glass. The increase of brightness indicated by the above values is less than what should result from combining the light of the component stars of the two groups, but their adoption renders the opera-glass observations comparable with the telescopic.

According to the photometric observations *b* should be

* See *Monthly Notices*, vol. lxi. pp. 337, 396, 480 and 550.

slightly brighter than *a*, but visually the latter was decidedly brighter than the former. This difference is no doubt due to the orange-red colour of *b*,* and was greater with the $2\frac{3}{4}$-inch refractor than with the $6\frac{1}{2}$-inch reflector. All the observations have been reduced with a step value of 0·07 mag. In the last column of the following table, $6\frac{1}{2} = 6\frac{1}{2}$-inch reflector, p. 50; $2\frac{3}{4} = 2\frac{3}{4}$-inch refractor, p. 35; $1\frac{1}{2}$ = the $1\frac{1}{2}$-inch finder of the reflector, p. 12; and Op. = opera-glass.

Observations of Brightness of the Nova.

Date. 1901.	G.M.T. h m	Observations.	Magnitude.	Inst.
June 14	13 20	(36) 9 N 6 *a*	6·18	$2\frac{3}{4}$
14	14 5	(36) 8 N 7 *a*	6·11	,,
14	14 10	(36) 8 N 8 *a*	6·07	,,
17	12 40	(36) 12 N 3 *a*	6·39	,,
17	13 15	(36) 12 N 3*a*, N 8 *b*	6·26	,,
18	13 0	(36) 10 N 5 *a*	6·25	,,
18	13 25	(36) 10 N 5 *a*, (30) 10 N	6·28	,,
23	12 40	*a* = N 7 *b*	6·34	,,
24	12 30	(36) = N 12 *a*, (30) = N, (32) 5 N	5·62	,,
24	13 15	(32) 4 N 15 *a*, N 2 (36), N 2 (30)	5·46	,,
24	13 52	(32) 2 N 3 (36), N 3 (30)	5·36	,,
26	12 40	(36) 8 N 5 *a*	6·18	,,
26	13 10	(36) 9 N 5 *a*, (30) 10 N	6·26	,,
27	12 20	(36) 9 N 6 *a*, (30) 9 N	6·21	,,
27	12 53	(36) 6 N 8 *a*, (30) 8 N	6·07	,,
July 28	12 13	(36) 12 N 2 *a*, N 10 *b*	6·24	,,
28	12 25	(36) 9 N 5 *a*	6·21	,,
28	13 55	(36) 9 N 6 *a*	6·18	,,
29	12 50	(36) 10 N 6 *a*, N 10 *b*	6·10	,,
29	13 50	(36) 10 N 4 *a*	6·28	,,
Aug. 3	11 50	(36) 10 N 5 *a*	6·25	,,
3	13 5	(36) 11 N 4 *a*, N 10 *b*	6·17	,,
3	14 55	(36) 8 N 7 *a*	6·11	,,
4	12 0	(36) 8 N 5 *a*	6·18	,,
6	11 15	(36) 11 N 4 *a*, (30) 10 N	6·33	,,
6	14 0	(36) 12 N 3 *a*, N 8 *b*	6·26	,,
8	11 30	(36) 8 N 7 *a*, (30) 8 N	6·14	,,
8	15 0	N = *a*, N = *b*	6·59	$6\frac{1}{2}$

* Comparison with the results of other observers seems to show that red stars appear distinctly fainter to my eye than they do to those of most observers.

Date. 1901.	G.M.T. h m	Observations.	Magnitude.	Inst.
Aug. 8	15 0	N 2 *a*, N 10 *b*	6·17	1½
8	15 0	N 2 *a*, N 10 *b*	6·17	2¾
9	10 55	(36) 8 N 7 *a*, (30) 10 N 15 *b*	6·02	,,
10	12 50	(36) 13 N = *a*, N 8 *b*	6·36	,,
10	15 0	*a* = N 5 *b*	6·41	,,
10	15 0	*a* 1 N	6·32	Op.
11	14 20	(36) 10 N 3 *a*, N 10 *b*	6·17	2¾
11	14 20	*a* 1 N	6·32	Op.
12	12 5	N 1 *a*, N 8 *b*	6·27	2¾
15	11 0	*a* = N 3 *b*, N 10 *c*	6·56	,,
15	13 5	*a* 3 N	6·46	Op.
15	13 15	*a* = N 3 *b*	6·48	2¾
16	11 20	*a* 3 N	6·46	Op.
16	11 30	*a* = N 1 *b*, N 10 *c*	6·61	2¾
16	13 47	*a* 3 N 3 *b*	6·37	Op.
18	10 55	*a* = N 5 *b*, N 12 *c*	6·47	2¾
18	13 15	*a* 3 N 2 *b*	6·41	Op.
18	14 8	*a* 2 N 2 *b*, N 10 *c*	6·63	2¾
19	11 15	N 1 *a*, N 5 *b*, N 12 *c*	6·44	,,
19	14 8	N 2 *a*, N 7 *b*, N 12 *c*	6·37	,,
19	14 8	*a* 2 N 2 *b*	6·37	Op.
20	11 0	*a* 3 N 3 *b*	6·37	,,
20	11 20	*a* = N 4 *b*, N 12 *c*	6·49	2¾
20	14 0	*a* = N 4 *b*, N 12 *c*	6·49	,,
21	10 5	*a* 4 N 1 *b*	6·48	Op.
21	11 5	*a* 2 N 2 *b*, N 10 *c*	6·63	2¾
21	14 10	*a* 4 N 1 *b*	6·48	Op.
22	10 45	*a* = N 5 *b*	6·20	,,
22	11 54	*a* = N 3 *b*, N 12 *c*	6 51	2¾
22	13 30	*a* 3 N 2 *b*	6·41	Op.
22	14 45	*a* 3 N 2 *b*	6·41	,,
23	11 10	*a* 2 N 2 *b*, N 10 *c*	6·63	2¾
23	14 10	*a* 2 N 2 *b*	6·37	Op.
24	?	*a* 5 N = *b*	6·55	,,
24	13 35	*a* 3 N = *b*, N 12 *c*	6·65	2¾
26	10 47	*a* 4 N = *b*, N 10 *c*	6·72	,,
26	14 47	*a* 2·5 N 3·5 *b*	6·34	Op.
26	14 47	*a* 3 N = *b*	6·69	6½
27	13 55	*a* 3 N 1 *b*, N 12 *c*	6·63	2¾

Date. 1901.	G.M.T. h m	Observations.	Magnitude.	Inst.
Aug. 30	16 5	*a* 6 N, *b* 3 N 10 *c*	6·84	6½
Sept. 1	10 45	*a* 3 N = *b*, N 12 *c*	6·65	2¾
1	16 13	*a* 5 N, *b* 3 N 6 *c*	6·91	6½
3	8 30	*a* 5 N = *b*	6·55	Op.
3	10 35	*a* 3 N = *b*, N 12 *c*	6·65	2¾
4	8 48	*a* 5 N = *b*	6·55	Op.
4	10 5	*a* 4 N, *b* 1 N 10 *c*	6·75	2¾
5	9 12	*a* 4 N 1 *b*	6·48	Op.
5	10 8	N 2 *a*, N 5 *b*	6·34	2¾
5	12 50	N 3 *a*, N 6 *b*	6·27	,,
5	14 40	*a* 2 N = *b*, N 8 *c*	6·72	6½
7	9 15	*a* 4 N 1 *b*	6·48	Op.
10	10 0	*a* 4 N 2 *b*	6·44	,,
11	15 0	*a* 5 N = *b*	6·55	,,
14	16 0	*a* 4 N 1 *b*	6·48	,,
17	10 30	*a* 3 N 2 *b*	6·41	,,
18	9 2	*a* 5 N 0·5 *b*	6·53	,,
21	11 15	*a* 5 N 1 *b*	6·51	,,
Oct. 3	8 30	*a* 5 N 1 *b*	6·51	,,
6	7 25	*a* 5 N 1 *b*	6·51	,,
7	9 10	*a* 4 N 2 *b*	6·44	,,
14	9 35	*a* 7 N = *b*	6·62	,,
19	9 25	*a* 7 N	6·74	,,
Nov. 1	9 37	*b* 10 N 5 *c*	7·16	6½
3	8 20	*a* 9 N	6·88	Op.
3	10 5	*a* 12 N, *b* 7 N 6 *c*	7·17	6½
15	12 50	*a* 11 N, *b* 4 N	6·90	Op.
Dec. 10	13 55	*a* 13 N, *b* 7 N	7·07	,,
10	15 20	*b* 12 N = *c*	7·41	2¾
18	15 45	*b* 10 N, *c* 1 N	7·37	,,
1902. Jan. 14	13 40	*b* 10 N, *c* 3 N	7·44	,,
31	12 15	*c* 15 N 17 *h*	8·19	,,
Mar. 4	11 5	*c* 16 N 11 *h*, N 8 *g*	8·34	,,
5	11 15	*c* 15 N 15 *h*, N 8 *g* 9 *h*	8·14	,,
6	8 30	*c* 17 N 11 *h*, N 8 *g*	8·36	,,
Apr. 6	8 30	*g* = N 10 *h*	8·55	,,
24	9 5	*g* 2 N 5 *h*	8·80	,,
28	8 50	N 2 *g*, N 8 *h*	8·55	,,

Notes.

1901.
June 26. A little hazy.
July 28. Object-glass slightly dewed in last observation.
Aug. 3. Thin cirrus cloud may have slightly affected the result.
4. A little thin cloud about.
9. Very clear generally, but patches of haze.
Sept. 1. Slight haze. Sky very bright.
Dec. 10. Exceedingly clear. Nova just distinctly visible in the opera-glass.

Excepting where otherwise noted above, it may be assumed that the conditions were favourable.

The observations show that there was a decided temporary increase in the brightness of the Nova on 1901 June 24; but this seems to be the last instance of the kind, the remarkable fluctuations in brightness having almost completely subsided after this date. I feel confident, however, that some of the smaller changes recorded later were real, and not due simply to errors of observation. In particular the increased brightness of the star on September 5 was undoubtedly real. Apart from these slight changes there has been a nearly continuous decline in brightness. The Nova was seen for the last time with the opera glass on December 10, an exceedingly clear night.

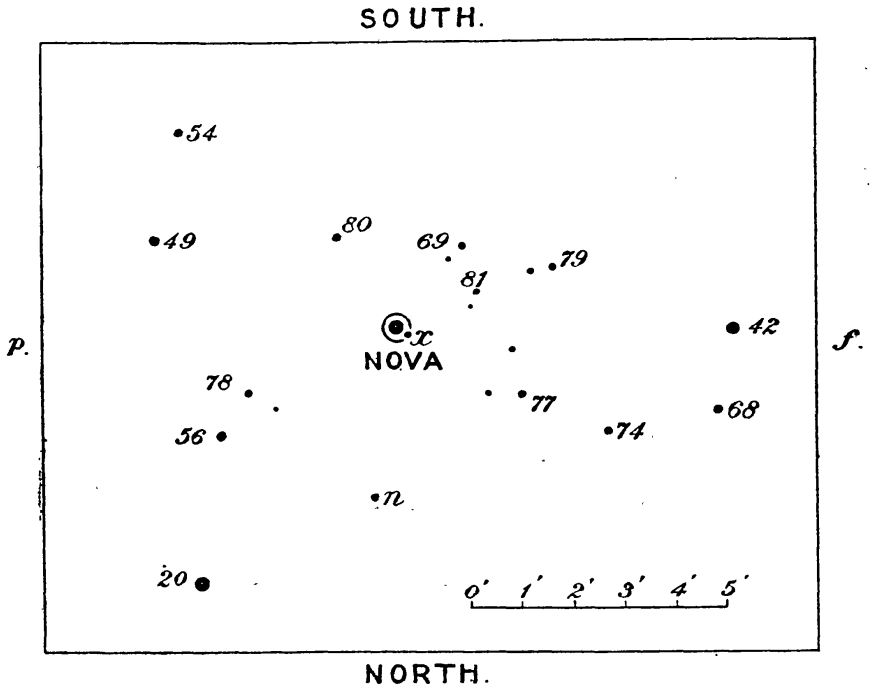
Notes on the Colour of the Star.

1901.
June 14. Little or no red colour, though appearance not the same as that of the comparison stars.
17. Colour seemed strongly reddish, but not more so than *b*.
23. Colour reddish, but not at all marked, and there even seemed at times to be a bluish tinge.
24. Yellowish with pale reddish flashes. On the whole the star was not as red as 36 Persei.
27. Hardly any red colour perceptible.
July 29. Hardly any red colour. The star was indeed slightly bluish, with an occasional yellowish red tinge. It was not nearly so red as *b*.
Aug. 6. Little or no red colour. Certainly not nearly so red as *b*.
8. Quite white, no red colour. No red colour with $6\frac{1}{2}$-inch refl., not even with a Kellner eyepiece which greatly intensifies yellow and red tints.
10. Bluish white, with perhaps occasionally a slight yellowish tinge.
11. Bluish white, with occasional pale reddish flashes.
12. Very pale reddish, not nearly so deep as *b*.
15. White, with occasionally a faint tinge of red or yellow.
18. White ($6\frac{1}{2}$-inch. refl. Kellner).
20. White.
22. White, with perhaps a slight reddish or yellowish tinge.
23. White.
26. White ($6\frac{1}{2}$-inch refl.). Nova had a perfectly stellar disc, with no trace of nebulosity.
27. White.
30. White ($6\frac{1}{2}$-inch refl.). The contrast between the orange red of *b* and the white of the Nova was very striking.
Sept. 1. White.
5. White, with perhaps a slight bluish tinge at times. With the $6\frac{1}{2}$-inch refl. white.
Nov. 1. Bluish white, even with the Kellner ($6\frac{1}{2}$-inch refl.).
Dec. 10. Colour seemed slightly greenish.
1902.
Jan. 14. Colour seemed bluish.
31. Distinctly bluish.

All the foregoing observations were made with the $2\frac{3}{4}$-inch refractor except where otherwise mentioned.

On the Photograph of 1901 *February* 20.

Short particulars of this photograph will be found in the *Monthly Notices*, vol. lxi. p. 337. As it appears that this was the last photograph taken before the apparition of the Nova, it becomes a matter of some interest to determine the magnitude of the faintest star shown by it. Visual estimates of the magnitudes of the fainter stars in this region have been published by Father Hagen * and Professor Aitkin.† The former used a 12-inch refractor, the latter a 36-inch refractor. The positions of most of the stars in the accompanying diagram have been



copied from Aitkin's chart, which is based on micrometer measures. The other stars, with the exception of x, have been added by estimation from Hagen's chart, and the positions of these are consequently not very exact. The numbers of the stars are from Hagen's catalogue. The following is a list of the fainter stars which are visible near the place of the Nova on the photograph of 1901 February 20, with the magnitudes as estimated by Aitkin ‡ and Hagen.

* "Second Chart and Catalogue for observing Nova Persei." See *Popular Astronomy*, vol. ix. p. 279.

† *Publications A.S.P.* vol. xiii. p. 68.

‡ Aitkin remarks that his estimates must be considered as relative rather than absolute.

Star.	Aitkin.	Hagen.	Star.	Aitkin.	Hagen.
49	...	11·0	77	13 0	12·7
54	...	11·4	78	13·2	12·8
56	12·5	11·4	80	13·0	(13)
68	...	12·1	*n*	13·8	...
74	...	12·4			

It seems certain from the foregoing list that if the new star had been as bright as 12·5 mag. on the photometric scale,* it must have left an impression upon this plate, unless it was of a red colour at the time.

In the *Astronomische Nachrichten*, No. 3755, Professor Ceraski has drawn attention to a star of about the 12th magnitude found by M. Blajko upon one of the Moscow photographs† very near to the place of the Nova, which star was completely invisible in a 15-inch refractor in 1901 December. What appears to be the same star is shown, not only by the photograph of 1901 February 20, but also by several other of my photographs of earlier date. The coordinates of the position of the star given by Ceraski are

$$\alpha = \alpha \text{ Nova} + 0^{s}\cdot 31 \qquad \delta = \delta \text{ Nova} - 7''.$$

Those from measures of the plate of 1901 February 20 are (for 1855)

$$\alpha = \alpha \text{ Nova} + 0^{s}\cdot 88. \qquad \delta = \delta \text{ Nova} + 7''.$$

These positions though not identical are so close that they doubtless refer to the same object. A high degree of accuracy is not to be expected from my measures, as the focal length of the portrait lens with which the photograph was taken is rather short (about 20 inches), and the star discs, even of the faintest stars, are somewhat large, owing to the region of the Nova falling near the edge of the plate. Nevertheless I do not think that the above difference of position can be in error by more than five seconds of arc. The position of x was measured on the plate of 1901 February 20; that of the Nova on a photograph taken on 1902 March 4, by which time the star had faded so much that its image is not very large. The two photographs were taken with the same instrument and under almost exactly similar conditions, and there can be no question as to a possible identification of the Nova with x. The faint star *Hagen* 80 is plainly visible on both plates, and it is evident, even to the eye, that the distance between this star and x is greater than that between it and the Nova.

The question as to what has become of x is a somewhat interesting one. As already stated it was invisible with the

* Hagen's magnitudes agree closely with the photometric determinations of Müller and Kempf down to the 9th magnitude.

† The photograph was obtained 1899 January 30.

15-inch Moscow refractor in 1901 December, whilst Aitkin failed to perceive it with the Lick 36-inch refractor in the spring of the same year.* It is, of course, possible that it is a long period variable, so that its invisibility may be only temporary, but the photographs do not seem to indicate variability. As already mentioned it is shown on several of the photographs taken here; and the following are the estimated photographic magnitudes of x on the different plates, assuming Hagen's visual magnitudes for the stars 49 and 54, and a step value of 0·07 mag.

Date.	Observations.	Magnitude.
1900 Dec. 22	(49) 7 x, (54) 10 x	11·79
1901 Jan. 15	(49) 12 x, (54) 10 x	11·97
25	(49) 12 x, (54) 10 x	11·97
Feb. 20	(49) 10 x, (54) 9 x	11·86

It will be seen that there is here little indication of variability.† The star is also said to be about 12 mag. on the Moscow photograph of 1899 January 30.

Hove: 1902 *May* 20.

Since the above was written Professor Ceraski has very kindly sent me an enlarged print from the Moscow photograph of 1899 January 30. This shows that the brightness of M. Blajko's star is about the same as that of the star x upon my photographs. The position, however, although very close, does not appear to be quite identical, so that it is difficult to conclude with absolute certainty that the same object is represented. This nevertheless is probably the case, the slight difference in position being perhaps due to photographic causes.

Professor E. E. Barnard has recently published micrometer measures of the faint stars in the vicinity of *Nova Persei* made by him with the 40-inch Yerkes refractor (see *Astronomische Nachrichten*, No. 3796). The position of the star x as measured on the photograph of 1901 February 20 corresponds very closely with that of Barnard's star No. 1, the magnitude of which is given by him as 14·7 (position angle 66°·59, dist. 19″·44 from the Nova). This star was overlooked by Aitkin with the 36-inch Lick refractor in the spring of 1901, but the great brightness of the Nova at that time would no doubt account for this.

* The star was looked for here unsuccessfully with the 6½-inch reflector in August or September of 1901, but owing to the brightness of the Nova at that time no importance can be attached to this negative evidence.

† The slightly greater brightness on 1900 December 22 is not real, but due to the fact that the star 49 is abnormally faint on this plate, so as to be slightly fainter than 54, apparently from a photographic defect.

Nova Persei. By Thos. W. Backhouse.

The following table gives details of my observations of Nova *Persei* :—Column 1 gives the date, column 2 the Greenwich mean time of the observation, column 3 the power of instrument used, 4 denoting opera-glasses, 9 the finder, and 20 a $4\frac{1}{4}$-inch refracting telescope. o.f. in this column denotes that the instrument was out of focus. Column 4 gives the assumed relative absorption for the night, calling it 1·0 when it is as clear as it is ever likely to be at the place of observation ; column 5 gives the assumed zenithal absorption in magnitude ; column 6 gives the calculated value of a step, column 7 the resulting magnitudes of the Nova, and 8 the comparison stars.

The last column is reserved for any notes to the observations, as hindrances &c. When the observation is made anywhere else than at Sunderland the place of observation is given in this column.

The method of comparison used is that of Argelander, namely, by step estimations, the Nova being compared with the stars named in column 8. First the magnitudes of the comparison stars in each sequence were computed, using as standards the Harvard photometric magnitudes taken from the Harvard Photometry, with the exception of those for *t*, *v*, *w*, and y^2, which are from the Harvard Durchmusterung. An allowance has been made in the case of *β Geminorum*, *κ Persei*, *t*, and y^2, on account of their ruddy colour, such stars appearing fainter to me than to the Harvard observers. Then an average of these resulting magnitudes for each star was taken, and these averages were adopted as standards for computing the Nova.

t and y^2 have sometimes been observed, but have not been used for obtaining the magnitude of the Nova unless inserted in column 8. Allowance has been made for atmospheric absorption in the cases where it is given in columns 4 and 5 ; in other cases it was not thought it would appreciably affect the result.

The stars with which the Nova has been compared are in *Perseus*, with the exception of *Capella*, *α Canis Minoris*, and *α* and *β Geminorum*, but I have used letters to denote the smaller stars, their identification being as follows :—

u = 36 Persei	v = B.D.+44°, 757 }
s = B.D.+45°, 811	„ 759 }
z = B.A.C. 1172	w = „ +43°, 730
r = B.D.+45°, 894	y = „ +44°, 734
t = „ +44°, 648	y^2 = „ +44°, 732

When the observation of *y* is thought to have included the